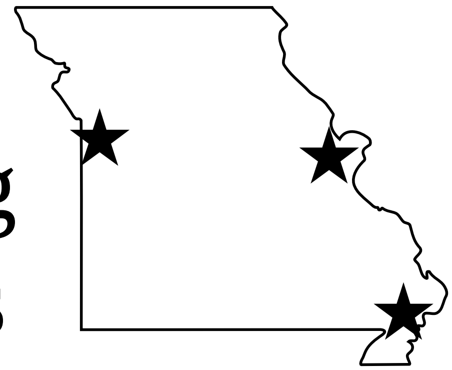
Prevalence of Diabetes among African Americans in the City of St. Louis, Kansas City, and the Bootheel Region of Missouri



Missouri Department of Health

Division of Chronic Disease Prevention and Health Promotion

Office of Surveillance, Research and Evaluation

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October 1997

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PREFACE

The Division of Chronic Disease Prevention and Health Promotion is proud to share with you this report, “The Prevalence of Diabetes among African Americans in the City of St. Louis, Kansas City, and the Bootheel Region of Missouri.” This report is the first in a series of monographs dealing with the burden of chronic diseases among minorities in Missouri. It highlights areas of concern related to the human and economic burden of diabetes and the associated challenges for public health in Missouri.

During this past year, the Division established a goal of increasing the number of chronic disease reports available to the public health community of Missouri. This concerted effort of our Office of Surveillance, Research, and Evaluation aims to provide critical information to public health professionals working in the chronic disease field for the planning and implementation of health-promoting programs in Missouri. Within the next twelve months, the Division will prepare and release four additional reports on the impact of chronic diseases on minorities, one monograph focusing on all chronic diseases and related factors in Missouri, and one monograph on cancer with a focus on both county-level and statewide burden. In addition, ten scientific manuscripts will be published in peer-reviewed journals.

It is our goal to share data and other information available from health assessments and surveillance in order to direct efforts toward improvement of the health status of the citizens we serve. This goal cannot be achieved unless we disseminate this very meaningful data to policy makers, planners, program managers, and health professionals throughout the state in a timely manner.

I am pleased to share this report with you and others in the public health community. I look forward to a continuing flow of information from this Division which will help guide and direct our efforts in reaching our vision of “Healthy Missourians in Healthy Communities.”

Bernard R. Malone, M.P.A., Director
Division of Chronic Disease Prevention and Health Promotion

October 1997

EXECUTIVE SUMMARY

Surveys of 2,095 adults in the City of St. Louis, Kansas City, and the Bootheel region were conducted by the Missouri Department of Health and the Center for Advanced Social Research, University of Missouri-Columbia School of Journalism in 1996 to determine the prevalence of diabetes in these areas. Because there is little information about diabetes among minority populations, these communities were selected due to the high proportion of African Americans living there. Survey findings for adults in these areas include the following:

- ✔ One of every eleven adults in these areas has diabetes.
- ✔ The rate of diabetes in these areas is 9.0%, nearly double the statewide average rate of 5.0% for the period between 1989 and 1994.
- ✔ Among African-American respondents, the rate of diabetes is 11.2%, twice that found in whites (5.1%).
- ✔ The rate of diabetes is about ten times higher among survey participants age 45 and older compared with those less than age 45, regardless of race.
- ✔ The rate of diabetes is especially high among:
    - African Americans age 45 and over living in the Bootheel (41.3%);
    - African Americans age 45 and over with an activity impairment due to heart disease or other health problems (57.2%); and
    - individuals age 45 and over who have health insurance but still have trouble getting health care due to cost (29.1%).
- ✔ After considering age and race, the highest rates of diabetes occur among:
    - those with a high school education or less;
    - residents of the Bootheel;
    - those with an activity limitation or physical impairment;
    - the physically inactive;
    - the obese; and
    - current or former smokers.
- ✔ Only slightly more than half of the respondents with diabetes who report using insulin monitor their glucose at least daily.
- ✔ One-third of diabetic respondents monitor their blood glucose levels less than weekly.

If diabetes prevalence rates are applied to census data, an estimated 27,400 residents of these three areas will have been told by a doctor that they have diabetes. Of these, 2,971 will be individuals age 44 or younger and 24,429 will be people age 45 and over. Based on other research, it is likely that a significant number of residents in both age groups have diabetes but have not yet been told this by a doctor (i.e., their diabetes remains undetected and undiagnosed).

These findings suggest diabetes is an important public health issue for adults living in the surveyed communities. Inattention to these individuals will result in increased costs due to frequent hospitalizations and significant, permanent disability.

Legislation requiring insurance companies to provide coverage for the management and treatment of diabetes was passed during the 1997 Missouri General Assembly and will become effective on 1 January 1998. One intent of this legislation is to increase glucose monitoring availability among those who are diagnosed with diabetes. Regular glucose monitoring and taking action to maintain a normal level are ways individuals can reduce the risk of suffering major diabetes-related complications.

INTRODUCTION

Diabetes is one of the leading causes of death in the United States (U.S.). National data show the disease to be more common and severe among African Americans than whites. For example, African Americans are far more likely to suffer the disease's major complications (e.g., blindness, amputation of limbs, kidney failure, and stroke). One purpose of this study was to determine the prevalence of diabetes among African Americans in Missouri. A second purpose was to examine other health factors associated with diabetes in this population.

In many cases, diabetes can be controlled through self-care approaches such as diet, exercise, and weight loss. Research has shown that in individuals whose diabetes cannot be controlled with diet and exercise alone, appropriate medical care, including tight control of glucose levels in the blood, significantly reduces the major complications of the disease. For these reasons, the findings of this study raise important policy issues.

METHODS

Sampling and Analysis

The Missouri Department of Health (MDOH), Division of Chronic Disease Prevention and Health Promotion (CDPHP) surveyed 2,095 residents of the City of St. Louis, Kansas City, and the Bootheel region (including Mississippi, New Madrid, Pemiscot, Dunklin and Scott counties but not including Stoddard County). Telephone interviews were conducted by CDPHP - Office of Surveillance, Research and Evaluation (OSRE) and the Center for Advanced Social Research (CASR), University of Missouri-Columbia (MU) School of Journalism between May and September 1996. Participants were selected by random-digit-dialing (RDD) techniques (see Appendix A).

By selecting these three regions of the state, investigators made a deliberate attempt to include a large number of African Americans. Sample populations were identified using census data and ZIP codes to target areas where more than 40% of the residents were African-American. Data were weighted to compensate for unequal probability of selection and representation of some elements of the sample population (for example, young men are frequently undersampled in telephone surveys). See Appendix A for additional details regarding study methods.

Investigators generated race- and age-specific prevalence estimates for self-reported diabetes and glucose monitoring across a variety of sociodemographic and other factors.

Variable Definitions

For purposes of this study, data and respondents were categorized as follows:

- **Frequency of diabetes –** Participants were considered diabetic if they answered “yes” to the question: “Have you ever been told by a doctor that you have diabetes?” Women who were told they had diabetes only during pregnancy were not included because gestational diabetes usually resolves after the pregnancy.
- **Age –** Respondents were divided into two age groups: those age 45 and older; and those younger than 45 years of age.
- **Race/ethnicity –** Respondents were categorized as African American, white or "other." The "other" group included Asian/Pacific Islanders, Native Americans, and Hispanics. We analyzed whites and others together because of the small number of "other" ethnic/racial respondents and to highlight findings among African Americans.

- **Educational attainment –** Participants were divided into two groups: those with a high school diploma or less; and those with more than a high school education.
- **Body mass index (BMI) –** This is the standard method for defining obesity. BMI was calculated by dividing weight in kilograms by height in meters squared. Respondents were divided into two groups, according to their BMI: those with normal BMI or less (non-obese); and those with greater than normal BMI (obese). Women were considered obese if their BMI was 27.3 or higher; men were considered obese if their BMI was 27.8 or higher.
- **Physical activity –** A physical activity score was determined by dividing duration of exercise by frequency. Those considered active exercised two or more hours per week; the inactive exercised less than two hours weekly.
- **Fruits and vegetables –** Respondents were divided into two groups: those who consumed three or more servings of fruits and vegetables per day; and those who consumed two or less servings of fruits and vegetables daily.
- **Smoking habits –** Respondents were divided into three groups: current smokers; former smokers; and those who had never smoked.
- **Availability of health insurance –** Participants were divided into three groups: those who had health insurance and did not have a cost barrier when it came to accessing health care; those who had insurance but still experienced a cost barrier plus those who had no health insurance but did not experience a cost barrier; and those who had no insurance and whose access to care was limited by cost. Health insurance included Medicaid and Medicare as well as private insurance.
- **Activity limitation –** Respondents were classified as having a limitation if they answered "yes" to the question: "Are you limited in any way in any activities because of any impairment or health problem?" Those who answered "yes" were then asked to identify their major impairment or health problem. Respondents were designated as having an impairment due to diabetes if they indicated that diabetes caused the impairment or if they had one of the following: a walking problem; an eye or vision problem; a cardiovascular problem (e.g., heart disease, a stroke, or high blood pressure); or an emotional problem such as depression or anxiety. These problems are all common complications of diabetes.

Cartographic Analysis

A cartographic analysis was conducted to examine the spatial distribution of diabetes among African Americans in the three regions (see Appendix B for a detailed description of the methods used and the resulting maps). ZIP codes were selected as the unit of analysis for the majority of maps because they represented the smallest unit of survey data. Due to the small number of cases in some areas, certain ZIP codes were combined to calculate the weighted diabetes prevalence rates and estimated at-risk population. Before ZIP codes were combined, several socioeconomic

variables were considered to prevent dissimilar areas from being combined. These included percentage of African-American population, percentage of the population classified by the US Bureau of the Census as “poor” or “very poor,” percentage of population with no college education, and median rent. On those maps in which ZIP codes were aggregated, boundaries for combined areas are illustrated with dashes instead of solid lines. A footnote is included to alert the reader of this aggregation.

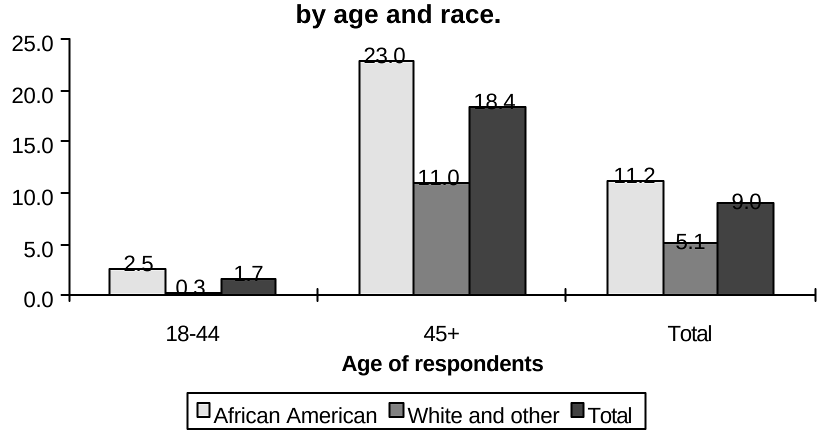
Three sets of maps were produced, one for each region (see Section VIII, page 19 and Appendix B). Each set contains four maps that depict ZIP code geography: the ZIP codes in each region included in the survey, number of study participants by ZIP code, weighted diabetes prevalence rate by ZIP code, and estimated number of diabetes cases for people age 45 or older by ZIP code.

RESULTS

Study participants (Table 1) were mostly African American (63.0%), female (62.5%) and/or age 45 or older (52.2%). The majority of those surveyed had a high school diploma or less (55.9%). Most had an annual household income of less than $25,000 (61.6%). Approximately half (52.9%) of all respondents reported less than two hours of physical activity per week. Slightly more than one-third (36.6%) of respondents were found to be obese and nearly one out of four (23.0%) reported an activity limitation.

The diabetes prevalence estimate of 9.0% for the three study regions was significantly higher than the average 5.0% previously reported by the Behavioral Risk Factor Surveillance System (BRFSS) for the state as a whole during the period between 1989 and 1994 (Figure 1). African-American respondents were more than twice as likely to have diabetes (11.2%) than other respondents (5.1 %) (Table 2). Diabetes was ten times more prevalent among respondents age 45 and older (18.4%) when compared with those less than 45 years of age (1.7%).

Figure 1. Prevalence rate of diabetes by age and race.



For all respondents, regardless of race, diabetes was more common among those with a high school education or less (11.4% compared with 6.2% for those with more than a high school education) (Table 2). Prevalence of diabetes was more than three times higher among those with activity limitations (20.0%) than those with no activity limitations (6.2%). Prevalence was also higher among obese respondents (14.4% compared with 5.4% for non-obese respondents).

The prevalence rate of diabetes among African Americans varied considerably with age and other factors (Table 3). The highest prevalence rate for individuals age 44 and younger was 9.0%, reported by African-American respondents with activity impairments due to, or commonly associated with, diabetes -- difficulty walking, cardiovascular disease, vision problems, or

emotional problems. Diabetes prevalence rates were quite high for African Americans age 45 and older, especially those with diabetes-related impairments (57.2 %), individuals living in the Bootheel (41.3%), and those with an activity limitation (36.5%).

Among white and "other" respondents age 44 and younger, prevalence rates of diabetes were extremely low -- less than 1% (Table 3). Only white and “other” respondents living in the Bootheel, with a prevalence rate of 1.5%, exceeded this level. For white/other respondents 45 and older, the highest prevalence rates were found for respondents who reported a cost barrier to health care despite having medical insurance (32.6%), respondents with diabetes-related impairments (21.1%), and obese respondents (18.5%).

With few exceptions, prevalence rates of diabetes were higher among African Americans than whites/others for all age groups (18-44; 45+; and total) across all levels of factors selected for analysis (gender, education, location, activity limitation, impairment, BMI, physical activity, smoking, health insurance, and fruit/vegetable consumption) (Table 3). For African Americans age 18-44, those living in the Bootheel had a lower prevalence of diabetes than whites/others (0.1% v. 1.5%) living in the area. For African Americans age 45 and older, those who had health insurance but still experienced a cost barrier accessing health care had slightly lower prevalence rates of diabetes than whites/others (27.8% v. 32.6%) as did those who ate two or fewer servings of fruits and vegetables daily (13.9% for African Americans v. 14.5% for whites/others).

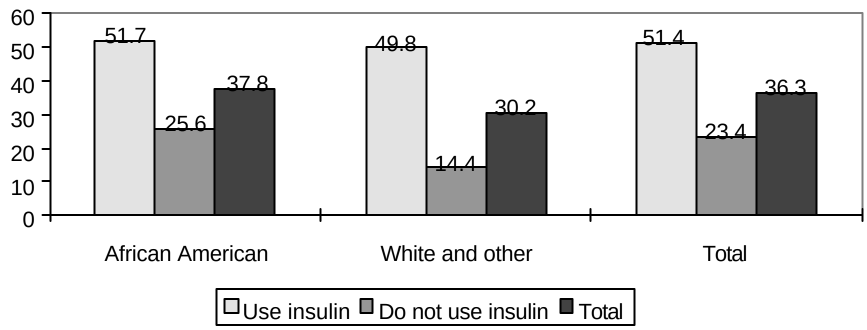
After adjusting for age and race, prevalence rates of diabetes were greatest for respondents with the following characteristics:

- high school education or less;
- residents of the Bootheel;
- activity limitation or impairment;
- obese;
- physically inactive; and
- current or former smoker.

Some of the study's findings may appear counterintuitive. For example, the prevalence of diabetes was found to be higher among respondents, both African-American and white/other, who had health insurance but experienced a cost barrier to health care than among respondents who were not covered and experienced a cost barrier (Table 3). African-American respondents who ate three or more servings of fruits and vegetables per day had a higher diabetes prevalence rate than those who ate fewer servings of fruits and vegetables.

Adequate monitoring of blood glucose levels was low, even among individuals with diabetes who used insulin (Figure 2). Approximately half of both African-American (51.7%) and white/other respondents (49.8%) who used insulin monitored their blood glucose level daily or more often. Only one-quarter (25.6%) of African Americans who did not use insulin reported monitoring their blood glucose levels on a daily basis. Significantly fewer white/other diabetics who did not use insulin reported daily monitoring (14.4%).

Figure 2. Prevalence of daily glucose monitoring among diabetics by race and insulin use.



About one-third (33.8%) of all respondents reported checking their blood glucose level less than weekly (not shown in table). Almost one-fourth (23.1%) reported never checking their blood glucose level.

Cartographic Analysis

A majority (56.9%) of the population of the City of St. Louis lived within the thirteen ZIP codes sampled, including 92.4% of the city's African-American population (Maps 1 and 2). The ZIP codes with the highest prevalence of diabetes -- ZIP codes 63115 and 63112, with rates of 14.5 and 13.2, respectively -- were located in the western and northern sections of the study area (Map 3). Other ZIP codes within the study area had prevalence rates ranging from 3.4% to 10.6%. Based on the prevalence rates, the study area would be expected to contain an estimated 11,874 inhabitants age 45 and over with known diabetes (Map 4).

While the ten ZIP codes sampled in Kansas City contained only 37.4% of the city's total population, they represented a large majority (81.3 %) of the city's African-American population (Maps 5 and 6). The northeastern part of the study site not only had the highest prevalence of diabetes in Kansas City -- 16.8 for ZIP code 64128 and 15.0 for ZIP code 64127 -- but the highest prevalence of all ZIP codes sampled in the study (Map 7). In the sampled area, there would be an estimated 10,457 people age 45 and older with known diabetes (Map 8).

The nine ZIP codes sampled in the Bootheel contained 28.9% of the region's total population, and 61% of the African-American population (Maps 9 and 10). The two areas in the southwestern portion of the Bootheel had a diabetes prevalence around 10%, while the two in the northeast had a weighted diabetes prevalence of 6.0% (Map 11). Based on the prevalence rates, 2,031 residents of the Bootheel ZIP codes sampled who are age 45 and older would be expected to have diagnosed diabetes (Map 12).

Note: further analyses by region (the City of St. Louis, Kansas City, and the Bootheel) are under way. Results from these regional assessments will be reported separately.

CONCLUSIONS AND RECOMMENDATIONS

African Americans living in the City of St. Louis, Kansas City, and the Bootheel are disproportionately affected by diabetes, with a prevalence rate more than double that of other racial/ethnic groups, including whites and Hispanics, living in the same regions. Diabetes is particularly a problem among African Americans age 45 and older, with almost one out of every four individuals in this age group having diabetes. These findings might be related to higher obesity levels among African Americans (40.9%) than whites and others (24.1%) living in these areas (not shown in table), as obesity is the major risk factor for diabetes among adults.

The high prevalence rate of diabetes among African-American participants who ate three or more servings of fruits and vegetables per day may be the result of these individuals changing their eating habits after their diabetes was diagnosed. Diet management, including an individualized meal plan, is a cornerstone of diabetes care.

The prevalence of diabetes was found to be high among respondents with health insurance who still experienced difficulty obtaining health care due to a cost barrier. Those who are disabled and insured by Medicaid, or older than age 65 and covered by Medicare, may experience a cost barrier to health care because these plans presently do not always cover the cost of glucose monitoring supplies. Lower prevalence among respondents with no health insurance could be related to a lack of medical care among these individuals, whose diabetes may be undetected.

In summary, study findings show that diabetes is a major health problem in Missouri. This is particularly true for African-American residents of the Bootheel, African Americans with additional health problems, and individuals of both races whose access to health care is impeded by cost. Inattention to these individuals could result in increased costs through frequent hospitalizations and significant, permanent disability.

Increased efforts are needed to identify diabetes early among these high-risk populations and monitor blood glucose levels among those individuals identified as diabetic. Missouri legislation on health coverage for all physician-prescribed, medically appropriate and necessary equipment, supplies, and self-management training used in the management and treatment of diabetes will become effective by 1 January 1998. This will increase glucose monitoring availability among those individuals diagnosed with diabetes who have health care coverage.

TABLES

Table 1. Unweighted frequency distribution of demographic and other selected factors among respondents in the City of St. Louis, Kansas City, and the Bootheel.

		All respondents	
		Number	Percent
Age	18-44	988	47.2
	45+	1094	52.2
Gender	female	1309	62.5
	male	786	37.5
Race	African American	1320	63.0
	white/other	764	36.5
Education	high school or less	1171	55.9
	> high school	918	43.8
Location	St. Louis	989	47.2
	Kansas City	703	33.6
	Bootheel	403	19.2
Income	<$15,000	862	41.1
	$15,000-$24,999	429	20.5
	$25,000 or more	612	29.2
	unknown	192	9.2
Have diabetes	yes	234	11.2
	no	1859	88.7
Activity limitation	yes	481	23.0
	no	1608	76.8
Impairment walking, vision, cardiovascular, diabetes, or emotional	yes	142	6.8
	no	1953	93.2
Body mass index	normal/non-obese	1258	60.0
	obese	766	36.6
Physical activity	< 2 hr/week	1109	52.9
	2 hr/week or more	892	42.6
Smoking	current	611	29.2
	former	452	21.6
	never	1029	49.1
Health insurance	yes/no cost barrier	1649	78.7
	yes/cost barrier and no insurance/ cost barrier	159	7.6
	no insurance/ cost barrier	284	13.6
Fruit/veg consump.	less than 3/day	805	38.4
	3/day or more	1220	58.2

Table 2. Weighted prevalence of diabetes across demographic and other selected factors among respondents in the City of St. Louis, Kansas City, and the Bootheel.

		Prevalence of diabetes among all respondents	
		Number	Percent
Age	18-44	2971	1.7
	45+	24429	18.4
Gender	female	15879	9.2
	male	11521	8.5
Race	African American	21799	11.2
	white/other	5600	5.1
Education	high school or less	18393	11.4
	> high school	8958	6.2
Location	St. Louis	14296	8.8
	Kansas City	10943	9.3
	Bootheel	2160	8.4
Income	<$15,000	12921	10.8
	$15,000-$24,999	5113	7.8
	$25,000 or more	5698	5.8
	unknown	3668	15.6
Activity limitation	yes	12079	20.0
	no	15195	6.2
Impairment walking, vision, cardiovascular, diabetes, or emotional	yes	5403	33.1
	no	21996	7.6
Body mass index	normal/non-obese	10284	5.4
	obese	15409	14.4
Physical activity	< 2 hr/week	17593	11.6
	2 hr/week or more	7302	5.1
Smoking	current	7998	6.6
	former	9045	14.6
	never	10357	9.1
Health insurance	yes/no cost barrier	21010	8.9
	yes/cost barrier and no insurance/ no cost barrier	3578	14.3
	no insurance/ cost barrier	2445	5.2
Fruit/veg consump.	< 3/day	6974	6.0
	3/day or more	18756	10.4

Table 3. Race and age-specific prevalence of diabetes across levels of selected factors among respondents in the City of St. Louis, Kansas City, and the Bootheel.

		African American			White and other		
		18-44	45+	Total	18-44	45+	Total
Gender[1, 2]	female	2.4	23.1	11.5	0.3	9.3	4.9
	male	2.6	22.9	10.7	0.1	13.4	5.2
Education[1, 2]	≤ high school	3.0	23.3	12.8	0.3	12.8	7.7
	> high school	2.0	22.2	8.6	0.2	9.3	3.5
Location[1]	St. Louis	2.9	21.8	11.0	0.0	6.9	2.9
	Kansas City	2.0	23.3	10.8	0.0	15.9	7.0
	Bootheel	0.0	41.3	18.3	1.5	8.9	5.4
Activity limitation[1, 2]	yes	7.0	36.5	23.5	0.0	16.0	12.4
	no	1.7	17.6	7.8	0.2	8.8	3.5
Impairment[1, 2] walking,	yes	9.0	57.2	39.2	0.0	21.1	16.4
vision, cardiovascular	no	2.2	19.6	9.3	0.2	10.2	4.6
diabetes, or emotional							
Body mass index[1, 2]	normal/non-obese	1.5	17.5	7.6	0.1	6.0	2.5
	obese	4.1	28.7	15.8	0.8	18.5	10.4
Physical activity[1, 2]	< 2 hr/week	2.4	26.2	13.6	0.4	13.3	7.6
	≥ 2 hr/week	2.1	16.2	7.0	0.1	6.6	2.4
Smoking[1]	current	3.4	21.0	10.8	0.3	17.4	5.8
	former	1.7	29.2	21.7	0.2	10.8	6.8
	never	2.2	20.4	8.1	0.2	8.4	3.6
Health insurance[1]	yes/no cost barrier	2.1	23.2	12.0	0.3	8.7	4.3
	yes/cost barrier and no insurance/ no cost barrier	5.4	27.8	14.5	0.0	32.6	13.9
	no insurance/ cost barrier	2.4	17.4	5.9	0.0	12.3	3.2
Fruit/veg consumption[1, 2]	< 3/day	2.8	13.9	6.8	0.2	14.5	4.5
	3/day or more	2.1	27.1	13.4	0.2	10.6	5.5

[1]Significant association ($p < 0.001$) between factor and diabetes after controlling for race
[2]Significant interaction ($p < 0.001$) between factor, race, and diabetes

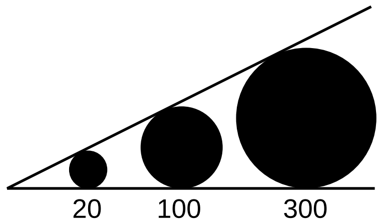
MAPS

St. Louis City

Map 1. St. Louis City ZIP code references

St. Louis City

Unweighted Number of Diabetes Study Participants by ZIP Code



St. Louis City Demographics

- Total people 396,685
  White 202,276
  African American 187,995
  Other 6,414
- People below poverty level 95,271
- People 25 years or older with no college education 164,187

Study Area Demographics

- Total people 226,431
  White 49,789
  African American 173,735
  Other 2,907
- People below poverty level 72,307
- People 25 years or older with no college education 88,324

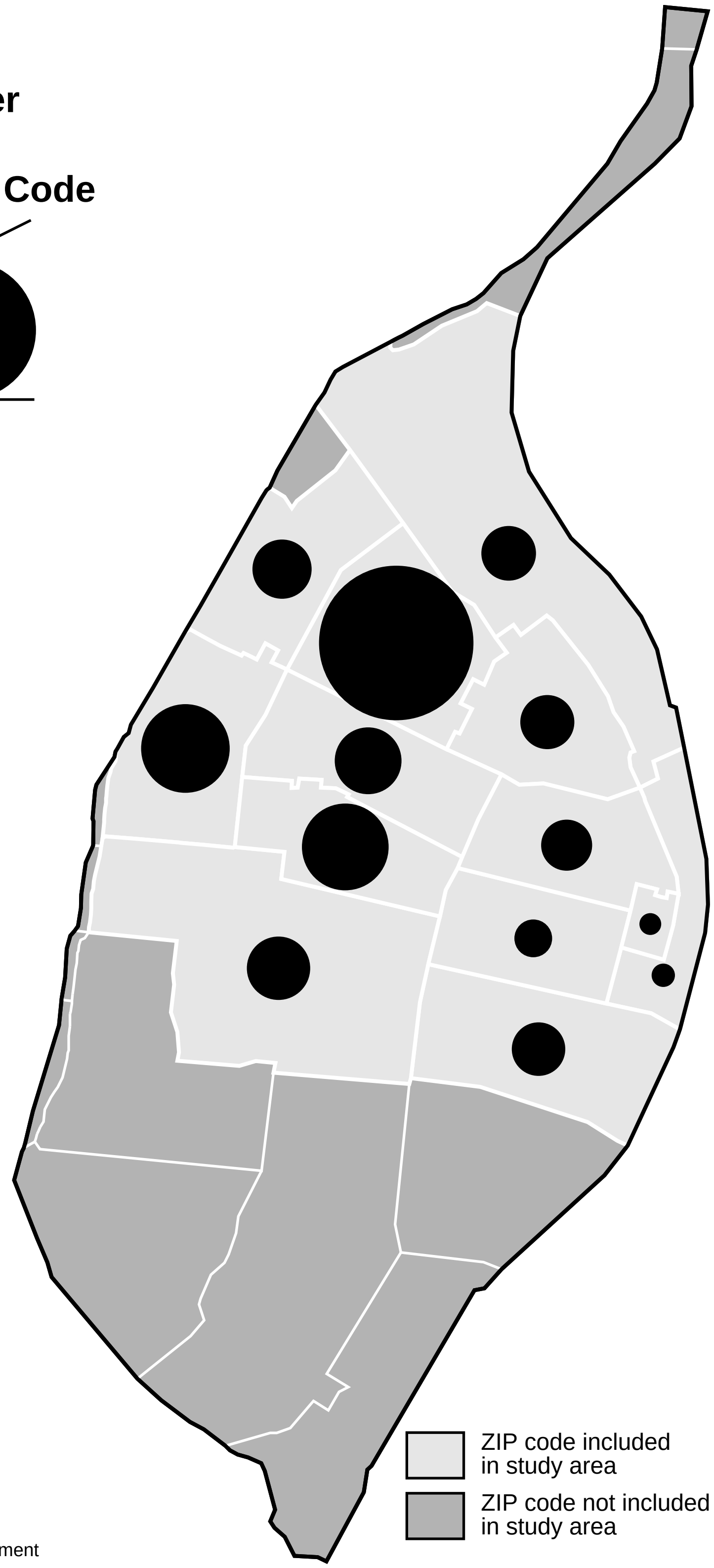
- Proportion of St. Louis City's population in study area 57.1%

- Proportion of St. Louis City's African-American population in study area 92.4%

- Proportion of St. Louis City's population below poverty level in study area 75.9%

- Proportion of St. Louis City's population 25 years or older with no college education in study area 44.0%

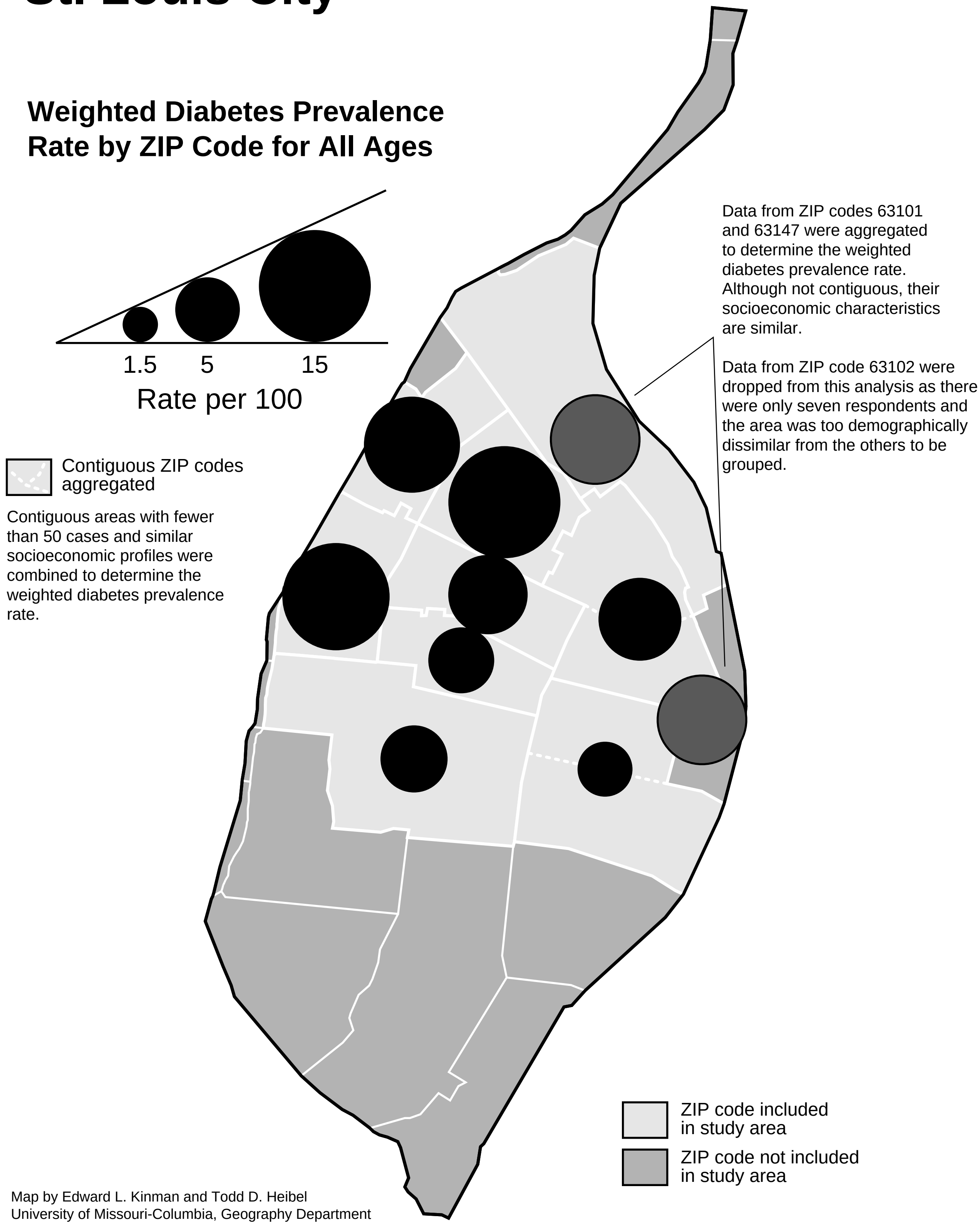
Source: U.S. Census Bureau, 1990.



Map by Edward L. Kinman and Todd D. Heibel
University of Missouri-Columbia, Geography Department

Map 2. St. Louis City diabetes study participants by ZIP code

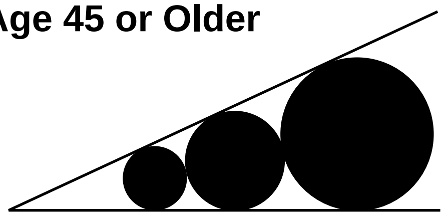
St. Louis City



Map 3. St. Louis City weighted diabetes prevalence rate by ZIP code for all ages

St. Louis City

Estimated Number of Diabetes Cases by ZIP Code for People Age 45 or Older



The estimated number of diabetes cases for each area was calculated by multiplying the area's susceptible population by its weighted diabetes prevalence rate for people age 45 or older.

Total population age 45 or older in study area = 69,234

Estimated total number of diabetes cases for people age 45 or older in study area = 11,874

Contiguous ZIP codes aggregated

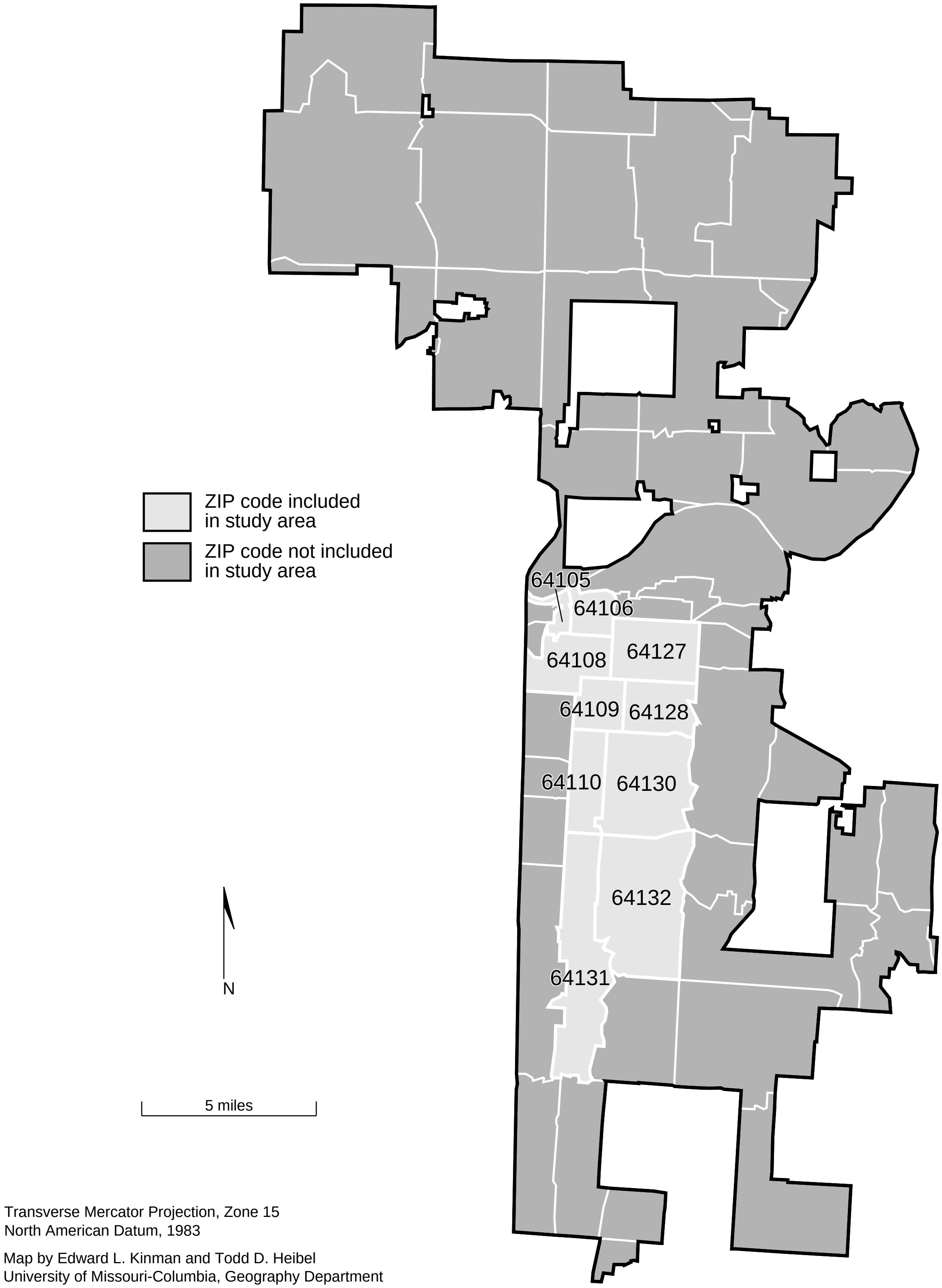
Contiguous areas with fewer than 50 cases and similar socioeconomic profiles were combined to determine the weighted diabetes prevalence rate.

Data from ZIP code 63102 were dropped from this analysis as there were only seven respondents and the area was too demographically dissimilar from the others to be grouped.

Map by Edward L. Kinman and Todd D. Heibel
University of Missouri-Columbia, Geography Department

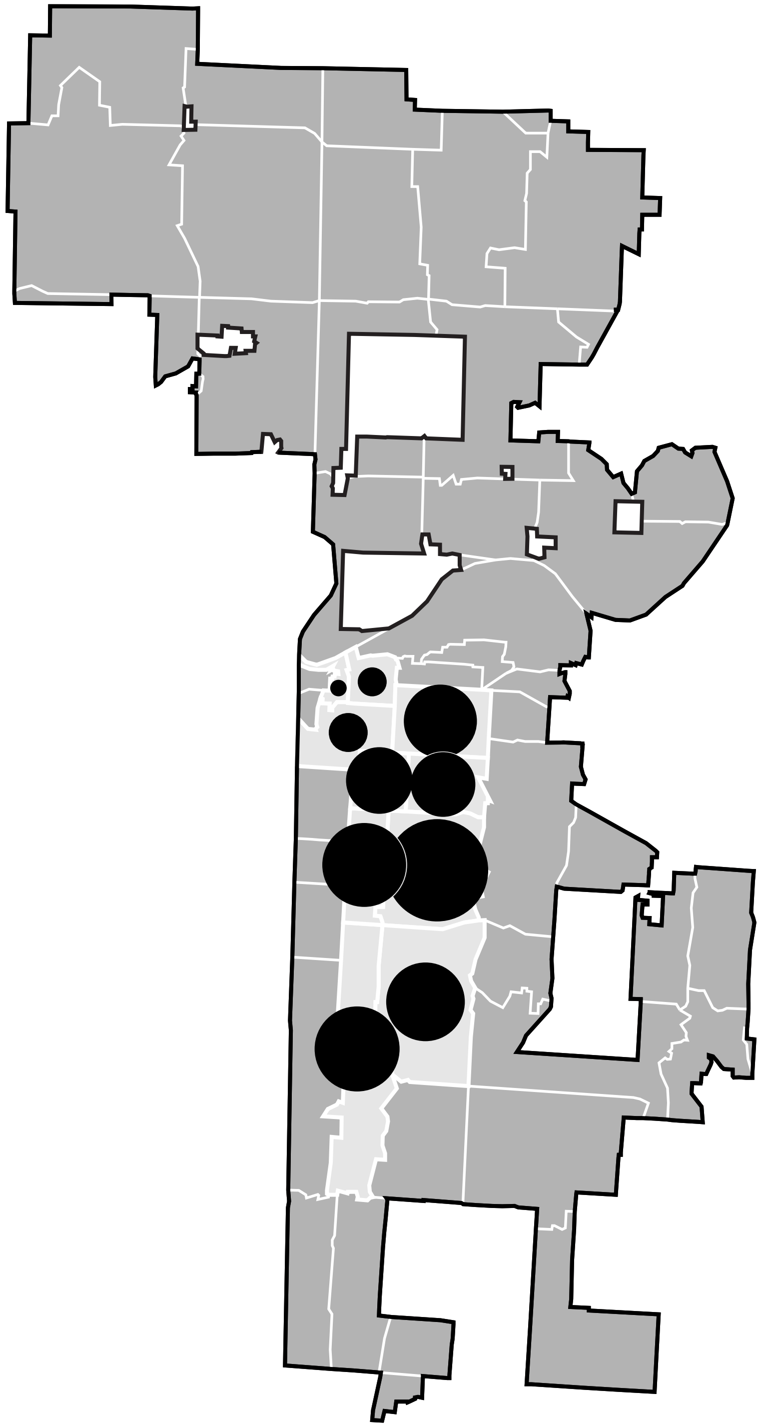
Map 4. St. Louis City estimated number of diabetes cases by ZIP code for people age 45 or older

Kansas City

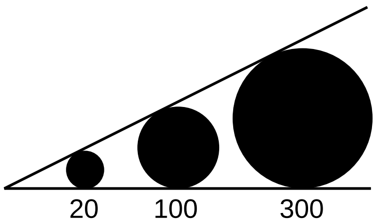


Map 5. Kansas City ZIP code references

Kansas City



Unweighted Number of Diabetes Study Participants by ZIP Code



Kansas City Demographics

- Total people 435,141
  White 290,898
  African American 128,843
  Other 15,400
- People below poverty level 65,381
- People 25 years or older with no college education 223,662

Study Area Demographics

- Total people 162,590
  White 50,912
  African American 105,171
  Other 6,507
- People below poverty level 42,641
- People 25 years or older with no college education 62,110

- Proportion of Kansas City's population in study area 37.4%

- Proportion of Kansas City's African-American population in study area 81.6%

- Proportion of Kansas City's population below poverty level in study area 65.2%

- Proportion of Kansas City's population 25 years or older with no college education in study area 27.8%

Source: U.S. Census Bureau, 1990.

ZIP code included in study area

ZIP code not included in study area

Map by Edward L. Kinman and Todd D. Heibel
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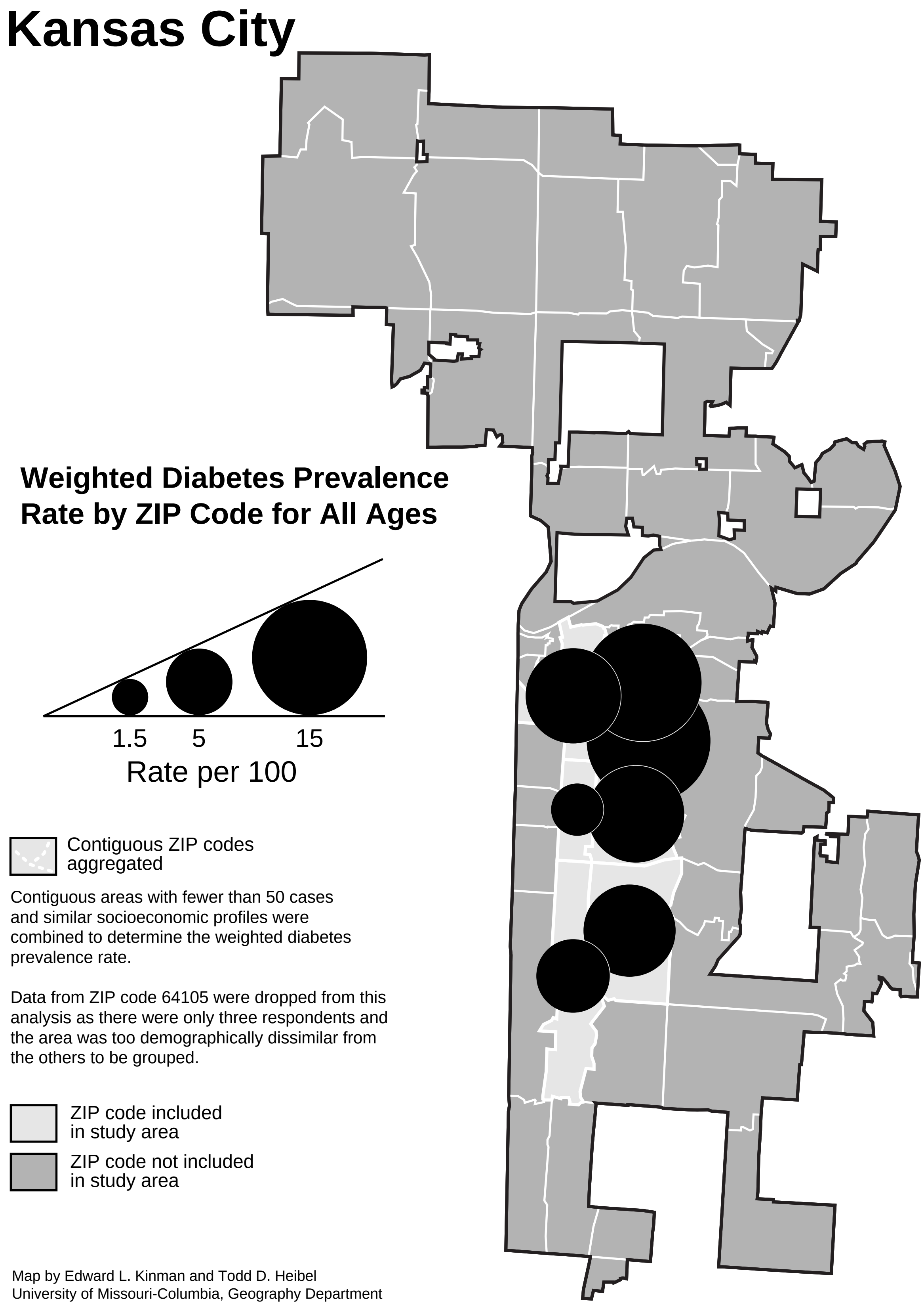
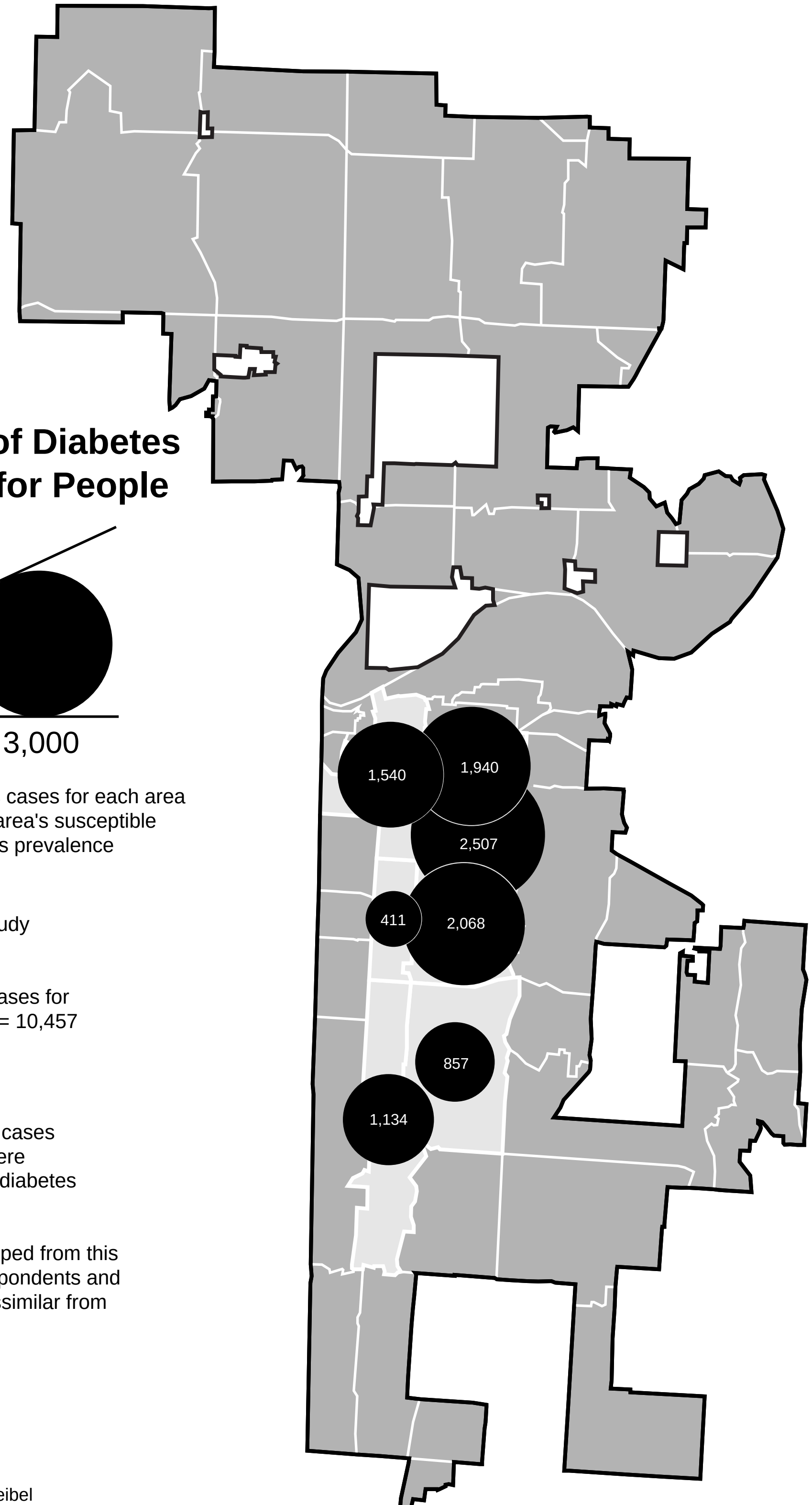
Map 6. Kansas City diabetes study participants by ZIP code

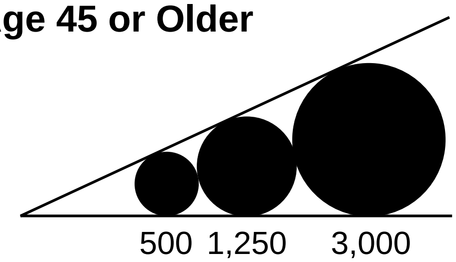


Map 7. Kansas City weighted diabetes prevalence rate by ZIP code for all ages

Kansas City



Estimated Number of Diabetes Cases by ZIP Code for People Age 45 or Older



The estimated number of diabetes cases for each area was calculated by multiplying the area's susceptible population by its weighted diabetes prevalence rate for people age 45 or older.

Total population age 45 or older in study area = 49,285

Estimated total number of diabetes cases for people age 45 or older in study area = 10,457

Contiguous ZIP codes aggregated

Contiguous areas with fewer than 50 cases and similar socioeconomic profiles were combined to determine the weighted diabetes prevalence rate.

Data from ZIP code 64105 were dropped from this analysis as there were only three respondents and the area was too demographically dissimilar from the others to be grouped.

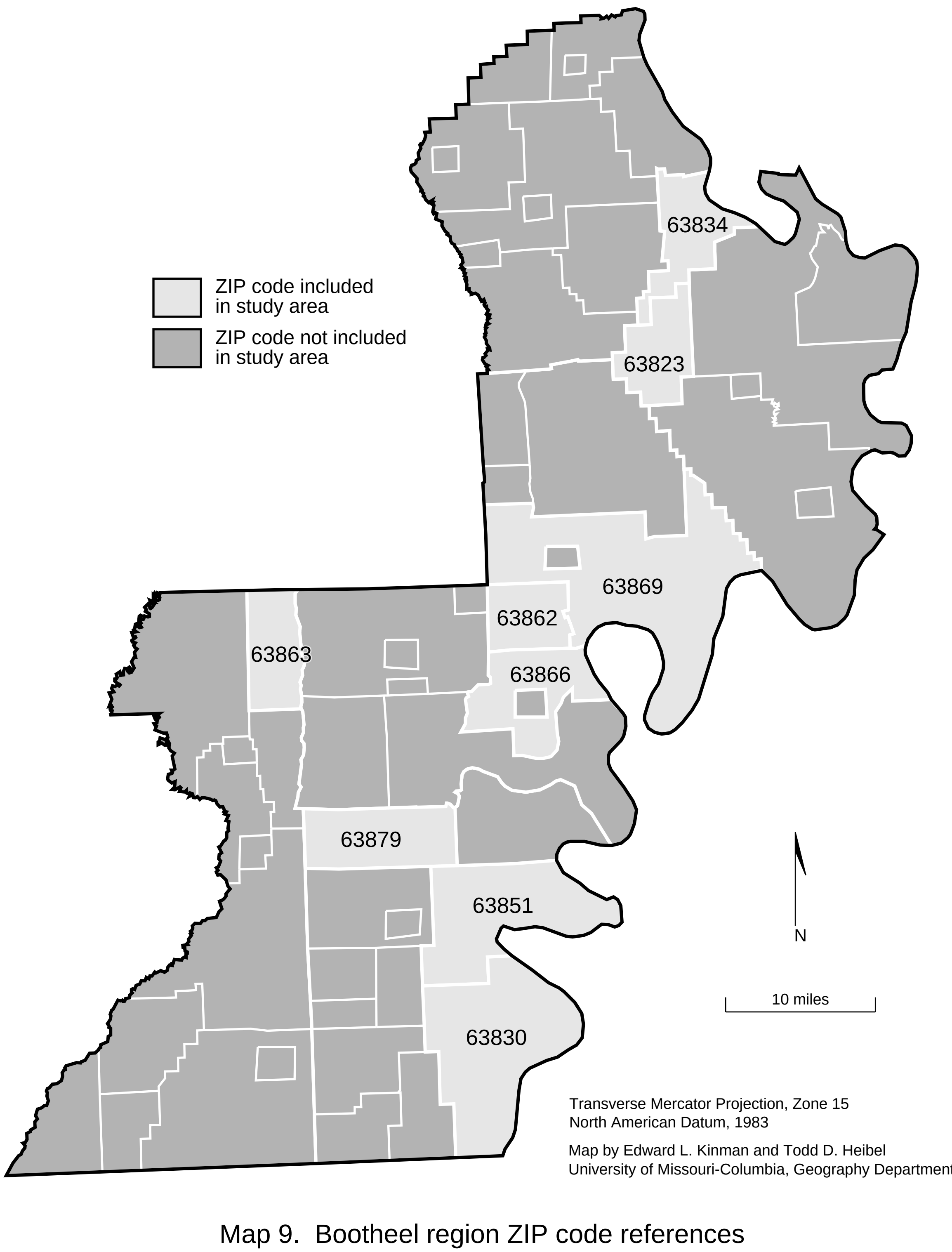
ZIP code included in study area

ZIP code not included in study area

Map by Edward L. Kinman and Todd D. Heibel
University of Missouri-Columbia, Geography Department

Map 8. Kansas City estimated number of diabetes cases by ZIP code for people age 45 or older

Bootheel Region



Map 9. Bootheel region ZIP code references

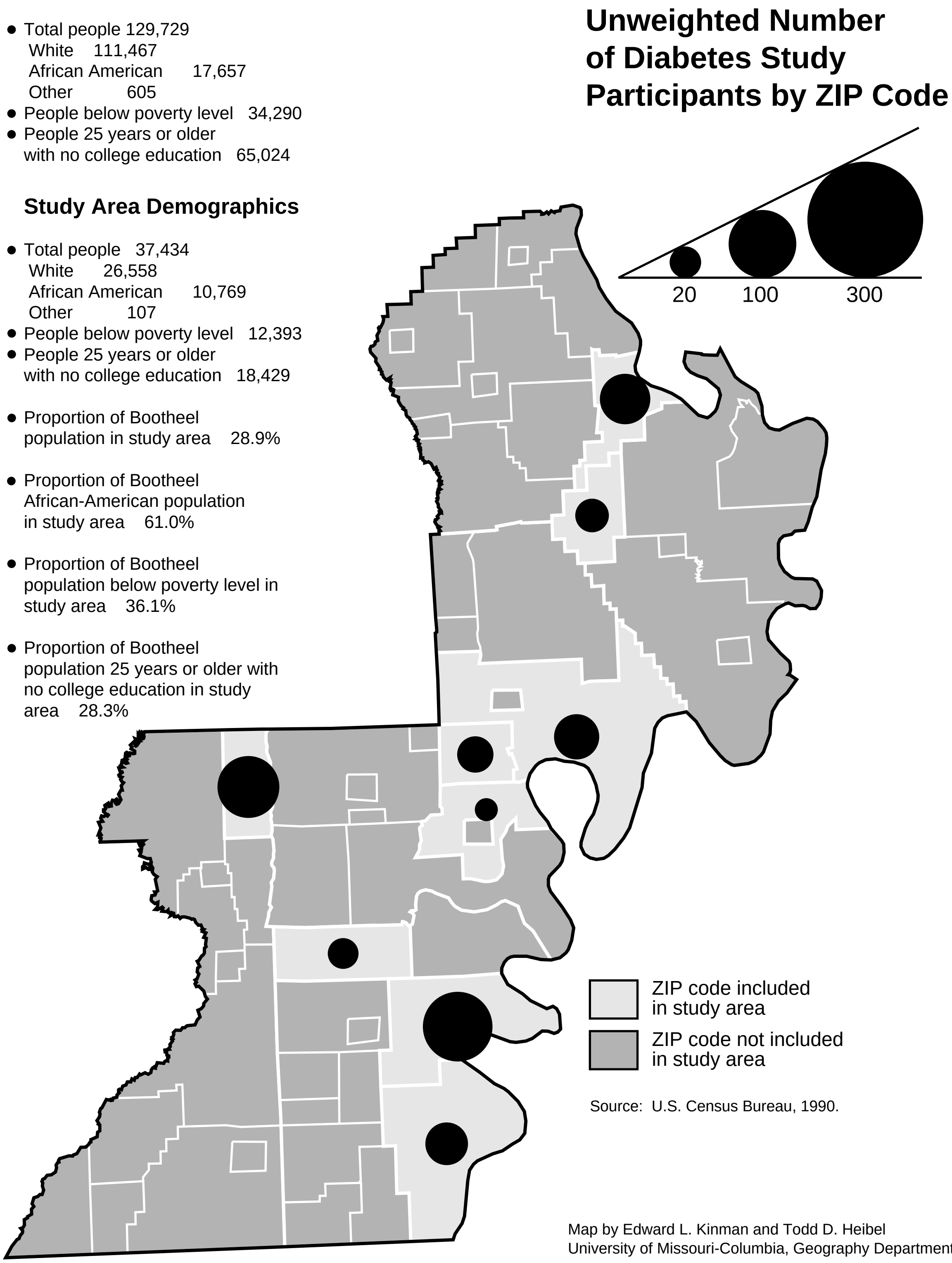
Bootheel Region

Bootheel Region Demographics

- Total people 129,729
  White 111,467
  African American 17,657
  Other 605
- People below poverty level 34,290
- People 25 years or older with no college education 65,024

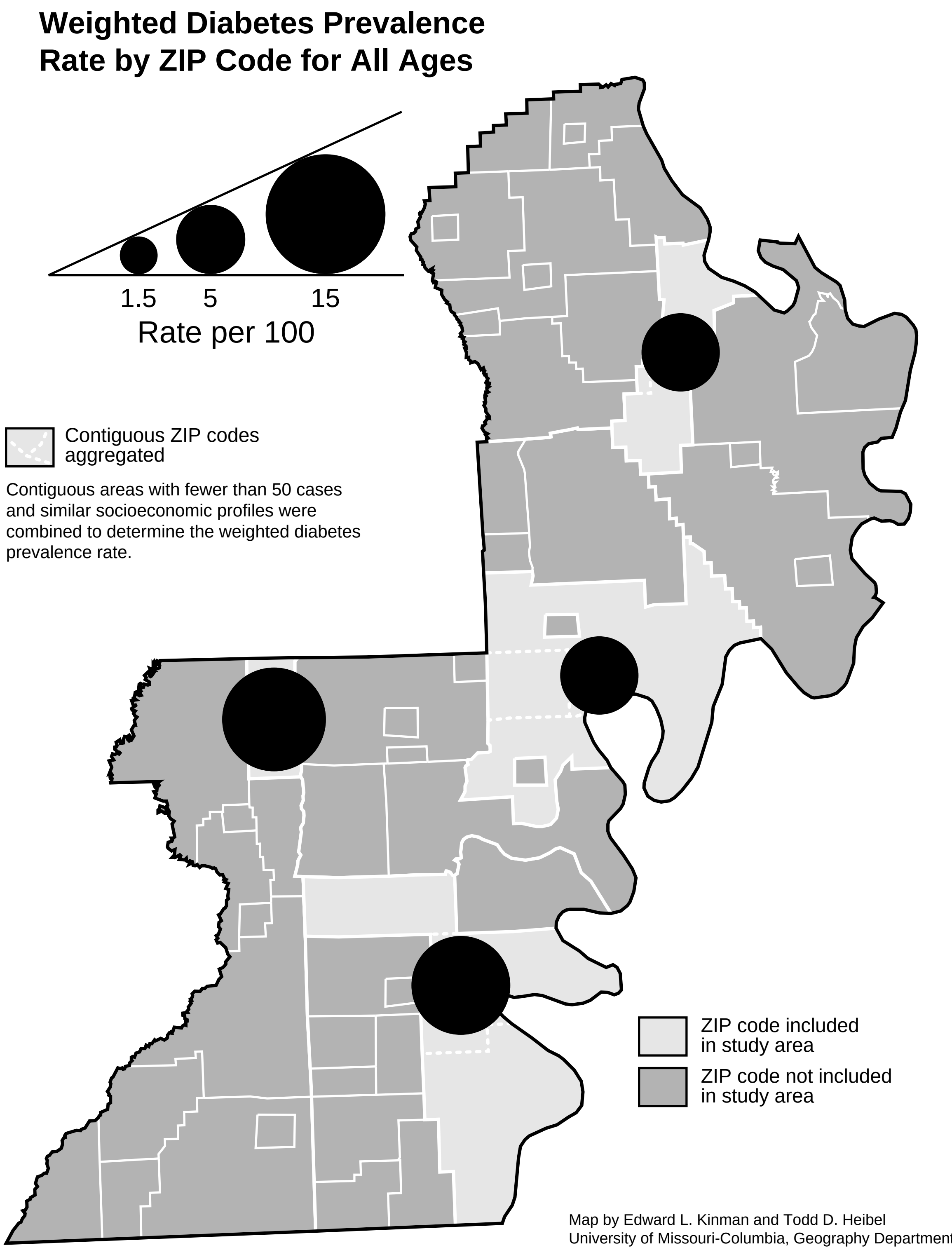
Study Area Demographics

- Total people 37,434
  White 26,558
  African American 10,769
  Other 107
- People below poverty level 12,393
- People 25 years or older with no college education 18,429
- Proportion of Bootheel population in study area 28.9%
- Proportion of Bootheel African-American population in study area 61.0%
- Proportion of Bootheel population below poverty level in study area 36.1%
- Proportion of Bootheel population 25 years or older with no college education in study area 28.3%



Map 10. Bootheel region diabetes study participants by ZIP code

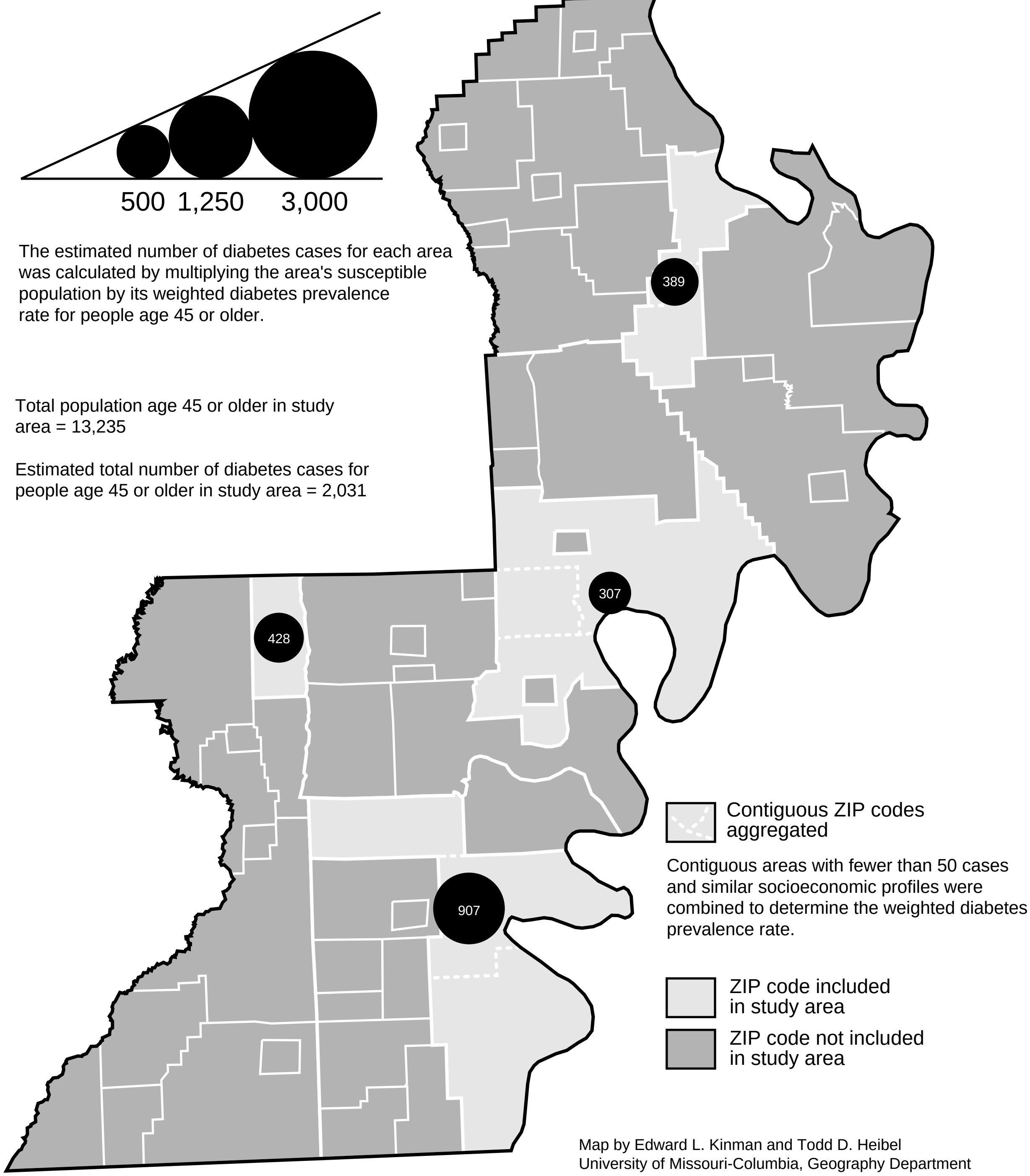
Bootheel Region



Map 11. Bootheel region weighted diabetes prevalence rate by ZIP code for all ages

Bootheel Region

Estimated Number of Diabetes Cases by ZIP Code for People Age 45 or Older



Map 12. Bootheel region estimated number of diabetes cases by ZIP code for persons aged 45 or older

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REFERENCES

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APPENDICES

APPENDIX A

DETAILED DESCRIPTION OF SAMPLE METHODOLOGY

Sampling

Using random-digit-dialing (RDD) techniques, the Missouri Department of Health (MDOH), Division of Chronic Disease Prevention and Health Promotion (CDPHP), Office of Surveillance, Research and Evaluation (OSRE) and the Center for Advanced Social Research (CASR), University of Missouri-Columbia (MU) School of Journalism, sampled 2,095 individuals from specific ZIP codes in the City of St. Louis, Kansas City, and the region in the extreme southeastern part of the state known as the "Bootheel."

CASR provided a 1990 census data listing of households and respective telephone numbers in St. Louis. A list purchased from a commercial phone bank firm, R.L. Polk Inc., provided full address and household telephone numbers for the Kansas City area. Based on the proportional representation of African Americans, we selected ZIP codes in these two areas with a 40% or higher African-American population. We cross-tabulated the selected ZIP codes with telephone prefixes using these lists. A combination of area code and prefixes was then used to generate the original list of telephone numbers available for sample, after elimination of prefixes occurring at lower frequency per ZIP code (twenty or less).

The sampling strategy varied by region. For the majority of interviews conducted by OSRE in selected ZIP codes in the City of St. Louis and Kansas City, a two-stage modified Mitofsky-Waksberg sampling frame was used. We first screened a generated random sample of possible telephone numbers to obtain stage one numbers (area code + prefix + suffix). If the stage one number was determined to be a working, residential telephone number, ninety-nine additional numbers having the same first eight digits (three digit area code + three digit prefix + first two digits of the suffix) were generated. This set of 100 numbers constituted the primary sampling unit (PSU) or cluster. We planned to complete either three or four interviews per cluster in the City of St. Louis and ten interviews per cluster in Kansas City. Additional interviews in both the City of St. Louis and Kansas City were obtained using a simple random sampling frame. Based on the telephone prefixes previously identified, all possible telephone numbers for the areas were generated. After elimination of numbers duplicated through cluster sampling, individual telephone numbers were randomly dialed until a predetermined number of interviews had been completed.

For the Bootheel region, CASR used a two-stage cluster sampling technique similar to the above and stratified by two sets of ZIP codes. For another smaller set of telephone numbers in selected zip codes of Kansas City, CASR used a simple random sample technique as described above.

Once a telephone number was selected, computer-assisted telephone interviewing (CATI) was implemented. CATI allows for random selection of eligible respondents within a household while maintaining the integrity of planned design by keeping actual versus expected number of interviews per cluster more or less constant. It also allows for standardization in the number of callbacks. For the CASR samples, the CATI system also allowed for an equally likely representation of males and females and older and younger respondents as well as minimum within-sampling-unit non-coverage error.

After excluding from further analyses observations with missing, inappropriate or non-response values for variables included in the analysis, the analytical samples presented varied from 1,901 to 2,095, depending on the variables being cross-tabulated. Household income had more observations excluded from analysis than any other variable; 194 respondents (9.3% of the total sample) either did not know their household income or refused to provide the information. For most variables, missing, inappropriate or non-response values led to the exclusion of fewer than twenty responses (less than 1%).

Analysis

Data were weighted to compensate for unequal probability of sampling selection as a function of stratification, clustering, unequal number of unique telephone number and adults per household. We also weighted the data to compensate for unequal representation of the source population according to sex, race and age (post-stratification). This weighting also minimized non-response and non-coverage which are differential across those groups defined by sex, age, and race.

We generated prevalence estimates for sociodemographic elements (gender, education level and location of residence), diabetes, health coverage (insurance), activity limitation, activity impairment, and other chronic disease-related factors, including body mass index (BMI), physical activity, smoking status and fruit and vegetable consumption. We generated race- and age-specific prevalence estimates of self-reported diabetes across levels of sociodemographic elements, health coverage, activity limitation, activity impairment, and chronic disease-related factors. We generated race- and age-specific prevalence estimates of adequate monitoring among individuals with diabetes across levels of sociodemographic elements, health coverage, activity limitation, activity impairment, and chronic disease-related factors.

Sample Description

The sample respondents were mostly individuals age 45 or older (52.2%), female (62.5%), African American (63%), with a high school education or less (55.9%), and/or with an annual household income of $15,000 or less (41.1%). The sample has an almost proportional representation of the surveyed areas (City of St. Louis, Kansas City, and the Bootheel region).

Weighted frequencies minimized some of the above noted differences by race, gender, age, education, income, and region. However, these differences remained after weighting and the distribution closely resembles the 1990 census information on these subsegments of the population.

Limitations of the Study

Data for this study were collected through telephone interviews with adult (18 years of age and older) residents of the three study areas. As a result, adult residents without access to a residential telephone had no opportunity to be considered during the random selection process.

In order to obtain additional information, face-to-face interviews were conducted in one ZIP code -- 63115 -- in St. Louis. These results will be reported elsewhere. Residents of ZIP code 63115 were oversampled in the telephone survey so that comparisons could be made between the face-to-face and telephone interview results. These results will also be reported separately.

Cautionary Note

Although we focused our results, discussion and conclusions on differences that are large and unlikely to be affected by random variation, the absence of confidence intervals makes it difficult to generate definite conclusions on this preliminary report. To that end, a more detailed manuscript is being prepared.

APPENDIX B

CARTOGRAPHIC ANALYSIS

Cartographic analysis is a key component in understanding the nature and extent of health problems for defined geographic areas (Earickson *et al*. 1989; Learmonth 1988: Meade *et al*. 1988). This appendix describes the methods of automated map production and analysis of study variables. Objectives are to:

- examine the spatial distribution of diabetes cases among African Americans in selected sites;
- compare how each site reflects the broader socioeconomic context of the region;
- analyze the spatial distribution of diabetes prevalence rates by ZIP code at each site; and
- compute and map the estimated diabetes rates by ZIP code at each site.

Hardware, Software and Type of Maps Used

The maps for this project were produced with Adobe Illustrator, a leading microcomputer-based, computer-assisted design program, on a Macintosh personal computer. The type of quantitative thematic map used in this report illustrates clearly the relative magnitudes of phenomena by geographic location. Proportional symbol maps use varying symbol sizes from place to place in accordance with quantities they represent. Proportional symbols can represent additive totals or derived ratio data. This technique also was chosen because it displays more quantitative detail than other techniques.

Spatial Units and Boundary Files

The City of St. Louis sample was drawn from twelve contiguous ZIP codes, which vary considerably in area and population (one ZIP code included in the study was excluded from cartographic analysis) (see Map 3). St. Louis ZIP codes range in size from 0.86 to 17.6 square kilometers and in population from 733 to 30,427. The Kansas City sample was obtained from a total of nine contiguous ZIP codes which ranged in area from 4.2 to 25.1 square kilometers and in population from 7,048 to 30,330. In contrast to these urban sites, only a few of the ZIP codes for the Bootheel were contiguous. The nine ZIP codes sampled in the Bootheel varied in size from 96.1 to 440.7 square kilometers and in population from 1,019 to 8,408.

A word of caution concerning the use of ZIP code boundaries for spatial aggregation is appropriate. ZIP codes represent an imposed, arbitrary boundary and do not necessarily reflect the natural distribution of the data collected. In the City of St. Louis and Kansas City, ZIP codes represent relatively large spatial areas for purposes of geographic analysis. This type of aggregation can mask variance.

City of St. Louis

Twelve ZIP codes within the city of St. Louis were sampled (Map 1). All ZIP codes for St. Louis are contiguous, which reflects the relative concentration of the area's African-American population. The total number of study participants in St. Louis was 982, with the number of cases per ZIP code ranging from six (ZIP code 63101) to 375 (ZIP code 63115) (Map 2). A majority (56.9%) of St. Louis's population lives in the study area as well as a large majority of the city's African-American population (92.4%). The study site contains 75.8% of the population living below the poverty level, considerably higher than the area's base population. By contrast, the proportion of the city's population 25 years or older with no college education is slightly lower than would be expected at 53.6%.

Several ZIP codes had fewer than fifty cases, the minimum number needed to calculate stable rates. As a result, the weighted diabetes-prevalence-rate map contains gradated circles for nine areas instead of the twelve sampled (Map 3). The ZIP codes with the highest rates were found in the western and northern sections of the study area. ZIP codes 63115 and 63112, with rates of 14.5 and 13.2 respectively, had the highest diabetes prevalence of the areas sampled. The two ZIP codes adjacent to 63115 also had relatively high diabetes prevalence, with a rate of 10.6 for ZIP code 63120 and 10.3 for the aggregated area of ZIP codes 63147 and 63101. The three southernmost ZIP codes had the lowest rates, ranging from 5.1 in ZIP code 63110 to 3.4 for the combined areas of ZIP codes 63103 and 63104.

Kansas City

A total of nine ZIP codes within Kansas City were sampled (Map 5). Like the City of St. Louis, all ZIP codes for Kansas City are contiguous, which reflects the relative concentration of the city's African-American population. The total number of survey participants in Kansas City was 700, with the number of cases by ZIP code ranging from 11 (ZIP code 64106) to158 (ZIP code 64130) (Map 6). While the ZIP codes included contain only 37.4% of Kansas City's total population, they represent a large majority of the city's African-American population (81.3 %). The study area contains 64.8% of the city's population living below the poverty level, which is almost twice as high as the area's base population. In addition, the study area contains a majority (53.6%) of Kansas City's population 25 years or older with no college education.

Just as in the City of St. Louis, there were several ZIP codes with fewer than fifty cases. As a result, the weighted diabetes-prevalence-rate map contains graduated circles for only seven areas instead of the nine ZIP codes sampled (Map 7). With rates of 16.8 for ZIP code 64128 and 15.0 for ZIP code 64127, the northeastern part of the study site not only has the highest rates in Kansas City, but of all ZIP code areas sampled in the study. The two ZIP codes adjacent to northeastern Kansas City also have relatively high prevalence of diabetes, with a rate of 10.1 for ZIP code 64130 and 9.8 for the aggregated area of ZIP codes 66406, 64108 and 64109. Of the three remaining areas, only ZIP code 64132 has a relatively high rate of 9.2

Bootheel Region

In the Bootheel region, a total of nine ZIP codes from Dunklin, Mississippi, New Madrid, Pemiscot and Scott counties were sampled (Map 9). Unlike the City of St. Louis and Kansas City, the ZIP codes included from this region are not all contiguous, which reflects the dispersed nature of the African-American population throughout the Bootheel region. The total number of participants from this area was 403, with the number of cases by ZIP code ranging from ten (ZIP code 63866) to 106 (ZIP code 63851) (Map 10). The differences in the number of respondents among ZIP codes generally reflects the variation in population among ZIP codes. The ZIP codes sampled contain 28.9% of the Bootheel's total population, and 61% of the region's African-American population. This disproportionate sampling was intended. The study area contains 36.1% of the region's population living below the poverty level, which is also higher than expected given the area's population base. By comparison, the proportion of the Bootheel population 25 years or older with no college education is close to expected at 28.3%.

The weighted diabetes-prevalence-rate map only displays data for four graduated symbols for the Bootheel region (Map 11). This is because several ZIP codes had fewer than fifty cases. The two areas in the southwestern portion of the Bootheel had a higher prevalence rate of diabetes than the two in the northeast. With a rate of 10.8 per 100 people, ZIP code 63863 had the highest rate of diabetes in the Bootheel. The combined area containing ZIP codes 63830, 63851 and 63879 had the second-highest rate with 9.8. By comparison, the other two aggregated ZIP code areas each had a weighted diabetes-prevalence rate of 6.0.

Copies of this publication may be obtained by contacting the Missouri Department of Health, Division of Chronic Disease Prevention and Health Promotion/Office of Surveillance, Research, and Evaluation,
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